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EDITORIAL

The following case was reported in the *Manchester Guardian* of July 26th, 1951:

William Jones, aged 57, suffering from burns of the face, was taken to Ancoats Hospital in January, 1950. He died whilst under the anæsthetic. The widow brought an action for damages for negligence against the anæsthetist, the Manchester Corporation and the Manchester Regional Hospital Board. The Corporation admitted negligence in respect of the burns and damages of £5 were awarded in respect thereto. Mr. Justice Oliver is reported to have said, "Dr. . . . who was stated to have qualified as a Bachelor of Medicine and a Bachelor of Surgery at Manchester University in July, 1949, should not have had access to Pentothal, or been allowed to adminster it without supervision. Through no fault of her own Dr. . . . had failed to exhibit that standard of skill which she was bound in law to possess." He added, "I may be wrong but I am going to say that the hospital authorities are 100 per cent responsible and the doctor not at all. I think to put a weapon like a barbiturate in the hands of a girl qualified

only five months and expect her to handle it and watch the patient is simply asking for trouble. I can't help it if it is common practice. It shocks me that this man should meet his death in this fashion. I don't blame her." Damages amounting to £1,343 and costs were awarded to the widow.

The Regional Hospital Board are, we understand, appealing against this judgement and so, as the matter is *sub judice*, comment must be deferred. However, there is no law against thinking, and this judgement would seem to provide much food for thought for anæsthetists, house surgeons, Hospital Boards and the General Medical Council.

INTRAVENOUS PETHIDINE IN ANÆSTHESIA
(A Report on 330 Cases)

By CECIL PEARCE

THE first series of cases in which pethidine hydrochloride was used to supplement nitrous oxide-oxygen anæsthesia was conducted in America (Neff, Mayer and Perales, 1947), and reports of its use in this country followed two years later (Mushin and Rendell-Baker, 1949). Subsequent reports from both sides of the Atlantic indicate that there is a wide variation in the actual quantities of pethidine administered by different anæsthetists.

Neff, Mayer and Thompson (1950) stated that the total dose used by them decreased as experience in the use of the method was gained, but that this was possibly due, in part at least, to the use of ether supplementation and curare for endotracheal intubation in extensive procedures. In cases not requiring intubation they used a slow induction technique giving nitrous oxide with 20 per cent oxygen until the anæsthesia was stabilised before injecting pethidine. Using this method, their average dose was at the rate of 30 mg. an hour, whereas in those cases in which thiopentone was used for induction the average hourly requirement was 37 mg.

Griffiths (1950) reported that, in 150 administrations, 25 mg. was adequate for procedures lasting as long as one and a half hours. The proportion of oxygen in the gas mixture was not stated nor the method of its administration.

Brotman and Cullen (1949) published an account of the use of pethidine in anæsthesia with particular emphasis on its value in geriatric surgery. Their dosage was approximately 100 mg. an hour using nitrous oxide with 30 per cent oxygen by the semi-closed carbon dioxide absorption method.

In the series of 330 cases presented below it has been the writer's practice to increase the oxygen concentration steadily throughout the operation rather than attempt to keep small the total quantity of pethidine used, with the result that the average amount per case has been 70 mg., or, approximately, 80 mg. an hour.

TABLE I
Age Distribution in Series

Age Group	Number of Cases
0–10	7
11–20	30
21–30	48
31–40	65
41–50	51
51–60	57
61–70	42
71–80	24
81–90	6

The age distribution of this series was fairly even apart from the upper and lower limits (Table I), and no significant difference has been found between the average quantities of pethidine used per hour in the various age-groups. The largest total dose used in this series was 210 mg., for a radical endaural mastoidectomy with drainage of cerebellar abscess, the operation time being 130 minutes.

The operation procedures for which this technique has been used and the number of each type are listed in Table II.

TABLE II

Numbers and types of operation making up this Series

Operation	Number of Cases
Appendicectomy	44
Cæsarean Section	11
Cholecystectomy	5
Colostomy	4
Exploratory Laparotomy	10
Gastrectomy (Subtotal)	14*
Gastroenterostomy	3
Gynæcological (Abdominal)	33
Gynæcological (Perineal)	61
Hæmorrhoidectomy	5
Herniotomy and Herniorrhaphy	53†
Mastectomy (Radical)	8
(Local)	3
Mastoidectomy (Radical Endaural)	8
Nephrectomy	3
Perforated Peptic Ulcer	15
Prostatectomy	22
Thyroidectomy	4
Miscellaneous	24

* Includes 6 emergency operations, 5 for hæmorrhage and 1 for perforation.

† Includes 15 strangulated herniæ, 5 of which were intra-abdominal.

PREMEDICATION

The standard premedication for patients of sixteen years and upwards was morphine sulphate 10 mg. and atropine 0.6 mg.; below this age atropine only was used.

TECHNIQUE—WITHOUT MUSCLE RELAXANTS

In all but 28 cases thiopentone was used for induction. The 5 per cent solution was found satisfactory for the majority of patients but for a few persons in the older age

groups and for all cases of Cæsarean section a $2\frac{1}{2}$ per cent solution, to which nikethamide was added in the proportion 1 volume of nikethamide to 5 volumes of thiopentone solution, was preferred. In either case the average amount of thiopentone used was 250 mg.

Pethidine was then administered through the same needle, after aspirating a small quantity of blood to prevent blockage, in amounts ranging from 15 to 50 mg., the actual quantity being based more on the effectiveness of the premedication than on the age or size of the patient. Nitrous oxide-oxygen administration was then commenced, using 20 per cent oxygen, and within a few minutes, the time usually taken for the "painting-up" and "towelling-up", the patient was usually sufficiently settled for surgery. In a few cases reflex movements of the fingers occurred when the towel clips were applied but a pause of a further minute or two, with, in a few cases, a small supplementary dose of pethidine, always produced a stable anæsthetic level without recourse being made to reducing the oxygen percentage.

During the operation the oxygen percentage was gradually increased so as to be nearer 30 per cent than 20 per cent by the end of the first hour, any rise in respiration rate or pulse rate being an indication for more pethidine rather than for less oxygen.

TECHNIQUE—USING MUSCLE RELAXANTS

The majority (86.6 per cent) of the cases in this series received muscle relaxants (Table III), d-tubocurarine chloride in the earlier cases and gallamine triethiodide or decamethonium iodide (C.10) in the later part of the series. When using gallamine a test dose of 20 mg. is always given before the thiopentone but

TABLE III

Number and types of cases receiving various muscle relaxant drugs

Operation Group	Total Cases	Curare	Gallamine	C. 10	Total
Intra-Abdominal and Herniæ	217	18	148	50	216
Perineal	66	5	53	3	61
Other	47	2	5	2	9
All Classes	330	25	206	55	286

in the case of decamethonium the test dose is omitted as it may give misleading results (Scurr, 1951). In either case the initial dose of relaxant is sandwiched between the thiopentone induction and the first injection of pethidine. Intubation, when required, is carried out immediately after the initial dose of pethidine, laryngeal reflexes being, as a rule, conspicuous by their absence which confirms the observations of Ruben and Andreassen (1951).

In the earlier part of this series relaxants were used only when specifically indicated, but more recently they have been employed to lessen the likelihood of reflex movements occurring, as may sometimes happen in such light anæsthesia.

Where repeated injections are to be made, the relaxant, usually gallamine, as decamethonium has been reserved for Cæsarean section and cases of short duration, is coloured to prevent any error in selecting the appropriate syringe. Not all dyes are compatible with gallamine, but the addition of a few minims of a solution of indigo-carmine, such as is used in the determination of renal excretion time, has been found satisfactory.

In all major upper abdominal operations and in abdominal gynæcology the patient is intubated with a cuffed tube lubricated with "K–Y" jelly containing 2 per cent cinchocaine, and anæsthesia is maintained by a 50 per cent mixture of nitrous oxide and oxygen using a circle absorber. Small gas flows have been found to be unsatisfactory as the usual Rotameter type of flowmeter for nitrous oxide possesses no graduations below 1 litre and also because the nearer the oxygen flow approximates to basal requirements, the greater becomes the percentage of nitrous oxide in the mixture breathed.

Usually one litre of each gas is allowed to flow and the expiratory valve is kept slightly opened permitting excess gases to leak away, thus avoiding any marked pressure increase. Assisted respiration is usually required, and at times controlled respiration may be of assistance to the surgeon. Apnœa can be readily produced by gentle rhythmic compression of the rebreathing bag, and control is easily maintained by periodic hyperventilation. The apnœic technique was used as a routine measure in 81 cases in the present series and was found to give ideal operating conditions with less physiological upset to the patient than any other technique used by the writer.

Gallamine has one minor disadvantage in that it produces a tachycardia in a high proportion of cases, thus rendering the decision as to when more pethidine will be required somewhat difficult. If, however, a hand is kept under observation, slight movement of the fingers will usually indicate the necessity. In addition a rise in blood pressure, when the possibility of carbon dioxide retention can be eliminated, is also to be regarded as a sign of lightening anæsthesia.

COMPLICATIONS

In a few cases profuse sweating has occurred associated with cutaneous vasodilation and this occasioned some apprehension until it became clear that, as far as the general condition of the patient was concerned, it was without apparent detriment. The possibility of contamination of the operation site by organisms carried, in the sweat, from the depths of the skin was felt to be a possible complication of this technique. In no case, however, has any wound sepsis occurred.

Several patients developed skin wheals extending along the vein used for the injection, but these subsided quickly and were not accompanied by any systemic effects.

Three cases of alleged sensitivity to pethidine have been reported (Zuck, 1951; Reynard, 1951; and Fielding, 1951), the details being similar in two of these reports, namely apnœa followed by bradynpœa, tachycardia and hypotension. In each of these cases the pethidine was injected after gas anæsthesia became established, and in neither was the oxygen percentage in the gas mixture increased until the operation was almost concluded, when, in each case, the administration of oxygen resulted in a rise of blood pressure which was maintained. No comparable case has been met in this series, although, on two occasions, the respiration rate fell dramatically after a repeat dose of pethidine, the normal rate being resumed very rapidly after the administration of pure oxygen for a brief period. In neither of these cases was there any blood pressure fall. Considering these facts, it appears to the writer that, as with almost any other problem in anæsthesia, the guiding principle should be—"When in doubt—give oxygen".

No pulse irregularities arose *de novo* in any case although in two elderly patients with existing auricular fibrillation the irregularity became more marked during anæsthesia. Whether or not this was a function of the tachycardia produced by gallamine it is impossible to state with certainty. It seems unlikely that the pethidine was responsible as it has been shown to exert a quinidine-like action on the rabbit heart (Dawes, 1946) and also to prevent cyclopropane-induced cardiac irregularities in dogs (Robbins, 1945).

Electro-cardiographic studies are now in progress and may be the subject of a further report.

USES IN SHOCK

This method of anæsthesia has been used in several shocked patients, including 5 cases of emergency gastrectomy for gross hæmatemesis and the characteristic feature has been the steady improvement in the patient's general condition and the complete absence of any post-operative state akin to cyclopropane shock.

SEQUELAE

In the 330 cases under review only one patient developed any significant respiratory complication. This was a rather wasted man, 63 years of age, who underwent gastric resection for carcinoma. For the first 3 post-operative days he had a troublesome cough with some tenaceous sputum associated with crepitations at the lung bases. Consolidation did not occur and the symptoms cleared completely with breathing exercises and a simple expectorant mixture. Similarly, post-operative vomiting has been gratifyingly infrequent, a fact appreciated by both patients and nursing staff alike.

No case of prolonged narcosis has occurred, all patients recovering consciousness within 10 minutes of the cessation of the anæsthetic, and the large majority within 5 minutes. In 2 patients with obstructive jaundice and deranged liver function there was no prolongation of the recovery time.

Finally, there were no deaths in this series which could be, in any way, attributed to the agents or techniques used.

SUMMARY

An analysis of 330 administrations of nitrous oxide-oxygen-pethidine anæsthesia is presented, with regard to the age distribution and nature of operation. The average dose of pethidine used was of the order of 80 mg. an hour.

The suggestion is put forward that adequate oxygenation at all times is of far greater importance than any attempt to keep down the dosage of that which, in the writer's hands, has not, so far, been shown to be a particularly toxic drug.

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"DIFFERENTIAL PRESSURE" RESPIRATION IN THORACIC OPERATIONS

By J. R. ESPLEN

IF two rubber balloons, different in size but of equal thickness of wall, are attached to the two limbs of a "Y" tube, it will be found that any attempt to inflate both balloons simultaneously will be defeated by the behaviour of the larger balloon, which always blows up in preference to the smaller one.

Observations made in the course of a series of 200 resections for pulmonary tuberculosis (to be reported in detail later) suggest that the principle involved in this simple experiment may be utilized to provide a quiet surgical field during intrathoracic operations.

Nitrous oxide - oxygen / thiopentone anæsthesia in combination with relaxants was used in these cases, and artificial ventilation was maintained in the usual way, by rhythmic compression of the breathing bag, up to the moment of pleural incision. The inflationary pressure was then reduced to range from 0 to between 5 and 7.5 cm. of water, until the lung on the operated side was seen to have undergone collapse; a process which was sometimes hastened by the deliberate application of pressure by the surgeon. Experience showed that there was little tendency for the contra-lateral lung to collapse during this interval provided that its pleural space was intact and that the degree of Trendelenburg tilt was not excessive. It was, however,

customary to increase the respiratory rate at this stage in order to minimise the reduction in ventilation resulting from the tidal volume of 150–250 ml. produced by the reduced pressure. After the desired degree of collapse had been achieved, it was observed that it was often possible to raise the inflationary pressure slowly, to range from 0 to between 10 and 15 cm. of water, and so produce a tidal volume of from 250–500 ml. without re-inflating the lung on the operated side. As a result an unimpeded approach and a very quiet field could be provided throughout operation.

Although this "differential" effect could be obtained by manual inflation of the lungs, it was found to be more satisfactory to use a machine for the purpose, since for optimal results it was necessary to maintain a regular respiratory rhythm and consistent pressures; a consistent return to atmospheric pressure at the end of pulmonary diastole (deflation) appearing to be of particular importance (Cournand et al, 1948). The differential effect could not be properly demonstrated when multiple cavities or emphysematous changes were present in the lung on the operated side, nor when an artificial pneumothorax or extensive lung pathology was present on the contra-lateral side.

On no occasion was any difficulty experienced in re-inflating the lung at the end of operation, and no post-operative complications have arisen on the operated side which could be attributed to the technique. In no case, so far as it can be ascertained, has an extension of disease become established in a new area suggesting a spill-over at the time of operation (Bickford et al., 1951).

An explanation of the effect described is appended, but it is felt that it is incomplete and that it probably oversimplifies the mechanisms involved.

Physical Principles (Fig. 1). Two elastic spheres of unequal size are shown connected to a source of pressure.

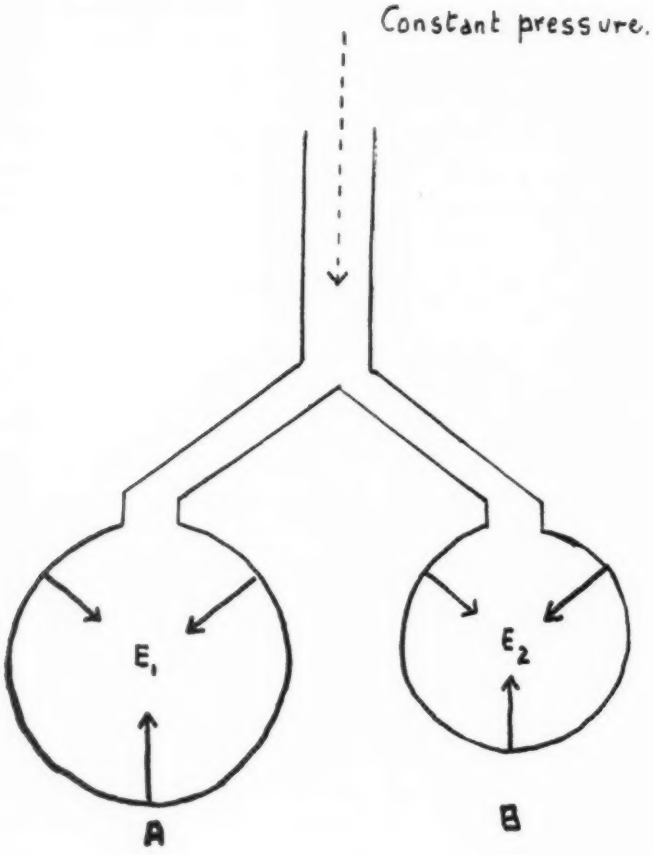

FIG. 1

The same pressure operates over each sq. cm. of the inner surfaces of both spheres. E1 and E2 represent the forces resisting expansion.

The expansion force, or total outward thrust, is in each case a product of the pressure and its area of application. In "B" this product is less than the resisting force and expansion does not occur. In "A" the product is greater and the sphere expands; the disproportionate gain in surface area having outmatched any increase in elastic resistance (Fig. 2).

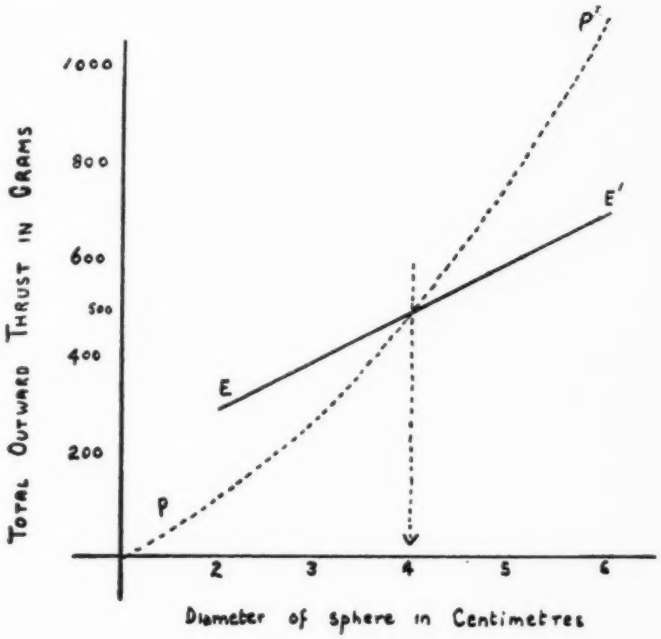

FIG. 2

The increase in the total outward thrust produced by a constant pressure of 10 g. per sq. cm. operating over the inner surface of an elastic sphere of progressively increasing diameter, is indicated by the curve "PP^1" (Fig. 2). The ordinates represent the total outward thrust or expansion pressure in grammes on the walls of a sphere at a constant pressure of 10 g. per sq. cm.

The increase in the elastic force resisting the sphere's expansion is shown as a straight line ("EE^1") in accordance with Hooke's Law.

If the elastic force resisting expansion is equal to an arbitrary figure of 500 grammes, it is apparent that the sphere must have a surface area in excess of 50 sq. cm. ($\pi \times 4^2$) if it is to expand under a pressure of 10 g. per sq. cm., and it will be seen from the graph, in terms of diameter, that this surface area is a critical one below which the sphere will deflate, and above which it will expand ever more freely at the same constant pressure.

SUMMARY

A procedure for maintaining adequate ventilation during thoracic operations with low inflation pressures and collapse of one lung is described. An attempt has been made to demonstrate the rationale and mechanical principles underlying this manœuvre.

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ANÆSTHESIA IN THE U.S.A.

By GORDON M. WYANT *and* MAX S. SADOVE

SINCE the inception of surgical anæsthesia, the English-speaking countries have been the pioneers of progress in this new field. Despite the constant exchange of ideas and the vast amount of literature on subjects related to anæsthesia, the specialty has developed along somewhat different lines in Britain and America. Each country has developed its own system of training, its own equipment, and has demonstrated certain preferences for agents and methods, not always shared by the other. This is not surprising if one considers that even within Britain there are marked regional variations; the pre-eminence of chloroform in Scotland is an example.

Papers have been published before in the English literature on Anæsthesia in the United States, but they have largely been from the pens of British visitors to the States after a comparatively short stay, during which they had visited some of the more prominent medical centres. The authors feel that they may have something more to contribute because of their more intimate acquaintance with both countries. One of them (G.M.W.) received his training in anæsthesia and did much of his post-graduate work in England, and has been teaching in the U.S.A. since 1950; while the other (M.S.S.) spent four years in the British Isles with the U.S. Forces during the late war; he then had occasion to visit many hospitals up and down the country.

This paper is presented in the hope that it may contribute something useful to anæsthesia in both countries by furthering the understanding of mutual problems. It must be emphasised at the outset that there is no such thing as "American Anæsthesia", and that this paper can only deal with general trends; there may be marked variations from these trends in the various centres.

ANAESTHETIC AND AUXILIARY AGENTS

Nitrous oxide, ether, cyclopropane, vinyl ether, ethyl chloride, thiopentone, bromethol and the muscle relaxants occupy a position in the United States similar to that which they hold in Britain.

Ethylene, however, which is almost never found in Britain, is a great favourite in the Middle-Western States of the Union and there is second only to nitrous oxide. Its properties and indications are roughly those of nitrous oxide, and its mode of administration is similar, but as it is slightly more potent, it may be used with a little higher concentration of oxygen, thus reducing the hypoxic hazard of nitrous oxide. Its high inflammability and explosiveness, however, limit its use as compared with nitrous oxide. A further disadvantage is that it is lighter than air, and explosive mixtures of the gas are therefore more widely distributed in the operating suite.

Trichlorethylene, on the other hand, so beloved in Britain, has never gained popularity in the United States and is used as rarely as is ethylene in England. The drug has never been able to recover from some early unfavourable reports of its pharmacological properties, despite the fact that clinical experience in Britain seems to invalidate these theoretical considerations.

If *chloroform* is rarely used in hospital-practice in England, it is hard even to find a bottle of the drug in the average American hospital. As far as the use of chloroform in domiciliary midwifery is concerned, the situation appears to be similar in the two countries, except that deliveries in the home are practically non-existent in the larger towns and are on the decrease in rural areas.

Where *cinchocaine* is the long-acting spinal analgesic of choice in Britain, amethocaine (Decicaine, Pontocaine) is the favourite in the United States for reasons which it is beyond the scope of this paper to discuss. While light and heavy solutions of amethocaine are commercially available, many anæsthestists prefer the use of crystals which are being dissolved at the time of lumbar puncture; by dissolving these crystals in distilled water a hypobaric solution can be prepared, while the addition of dextrose will result in a hyperbaric solution.

Carbon dioxide administration is rarely resorted to during anæsthesia. Any increase in pulmonary ventilation that may be desired is achieved by manual assistance of respiration or by temporarily excluding the soda-lime absorber from the anæsthetic system. Indeed the Army and the Veteran's Administration even expressly forbid the attachment of carbon dioxide cylinders to anæsthetic machines in their hospitals.

Helium, which for a time enjoyed much popularity, is now being used much less frequently than before. However, one has the impression that it is still more common in the States than in Britain. Its chief use is for asthmatic patients and for laboured breathing from other causes. Its employment during the post-operative period and for the dilution of explosive mixtures is definitely on the decrease.

Intravenous procaine has in the last few years become established as a valuable aid in the prevention of cardiac arrhythmias during thoracic surgery, and is widely employed also for the suppression of harmful reflex-activity in a wide variety of surgical procedures. In some cases it almost has assumed the role of a basal narcotic, but the exact status of intravenous procaine in anæsthesia must still evolve with the passage of time.

TECHNIQUES

Inhalation anæsthesia is administered by the closed, semi-closed and open techniques very much in the way it is administered also in Britain.

Intravenous anæsthesia with the ultra-short-acting barbiturates is administered in many centres by the continuous drip method, a technique less frequently encountered in Britain. The advantages claimed for this method of administration are that it affords a more even level of anæsthesia throughout the operation and that less fall of blood-pressure and less respiratory depression are encountered; it also prevents the often troublesome occlusion of the needle seen with repeated-dose administration. However, one cannot fail to notice that with the lighter plane of anæsthesia thus obtained, many more instances of laryngospasm from trivial stimulation are encountered than are seen with the fractional-dose technique, and the inadvertent omission to discontinue or slow the drip when the desired level of anæsthesia has been reached after induction is a potential danger. Concentration of thiopentone for continuous drip varies between 0.1 and 0.5 per cent, and occasionally a 1 per cent solution is employed for induction. For single or fractional-dose injection the concentration of

thiopentone practically never exceeds 2.5 per cent in the United States.

Continuous spinal analgesia is a very popular method in the U.S.A., presumably because operations tend to last so much longer than do the same procedures in Britain. Not at all infrequently analgesia is required for five, six, seven hours or even longer; and in these cases continuous spinal is one of the possible ways of providing analgesia over so protracted a period. Another important reason is that in continuous spinal, procaine, with its low toxicity, can be injected in small doses from time to time as required, thus avoiding the large single dose which is objectionable to many in the States. By correct positioning of the catheter-tip at the proper level of the spinal canal, analgesia can be obtained in just the segments only, where it is needed, thus further reducing the amount of drug required and minimizing the danger of serious hypotension (segmental spinal analgesia).

By and large the catheter-technique has replaced the malleable needle, and very excellent fine polyethylene and other plastic tubing is now available, which from many aspects is superior to the ureteric catheter previously employed.

Another technique for prolonging the action of spinal analgesia is the addition of small amounts of adrenaline 1 : 1,000, ephedrine, or of a similar vasopressor to the spinal solution. By this means it is possible to prolong analgesia with cinchocaine or amethocaine in the usual doses by an additional two or three hours.

In an attempt to decrease the incidence of spinal headache, the two-needle technique is gaining in popularity. In this, a 24- or a 25-gauge needle is employed for lumbar

puncture and is introduced through a larger needle which serves as a guide and has been advanced down to the ligamentum flavum.

Continuous caudal analgesia is quite popular for obstetrical analgesia in many places, although there appears to be at present a trend away from this method in favour of subarachnoid saddle-block. This is possibly due in no little measure to the fact that continuous caudal analgesia is a time-consuming procedure. That both caudal and spinal almost invariably necessitate the use of outlet-forceps is no factor, as this type of delivery is practised in the large majority of cases anyway.

Obstetrical analgesia with nitrous oxide and air, comparable with that obtained by the Minnitt apparatus, is not practised in the United States; and no machine is available for that purpose. Trichlorethylene, too, is rarely resorted to for the reasons already mentioned.

Indications for *tracheal intubation* are considered similar to those in Britain, with blind nasal intubation being much less popular in the United States. Where an air-tight fit is needed cuffed tubes are preferred rather than pharyngeal packs.

One of the striking features of anæsthesia in the United States is the tendency to use drugs in greater dilution than in Britain and to employ smaller doses initially, repeating the administration if and when required or resorting to the continuous-drip technique. Apart from thiopentone, this is particularly noticeable in the techniques worked out for muscle-relaxant drugs and in the administration of vasopressors and similar potent drugs. Premedication, too, with morphine or similar agents is somewhat lighter than one is used to after practising in Britain.

Record-taking during anæsthesia is a universal feature of American anæsthesia. Blood pressure, pulse and respiration are taken at intervals of 5–10 minutes and charted during all operations. Most charts available require the noting of additional data regarding the pre-operative medication and findings, observations and drugs given during operation, and post-operative status and complications. The chart used at our Institution is a punch record-card similar to the Nosworthy-chart, but somewhat larger and more comprehensive. The keeping of good records enables good statistical analysis, but unfortunately much of the clinical material is lost, as in the smaller institutions charts are filed with the patient's record and are thus not available for analysis. The chart used by us consists of two copies, a thin original sheet for inclusion with the patient's notes and a carbon-copy on stout card-board for punching and filing in the anæsthesia-department. Apart from providing adequate records, the mere fact that charts must be kept on all cases compels the anæsthetist to observe his patient closely, take regular readings, and re-assess his patient.

APPARATUS AND APPLIANCES

Machines. The principal brands of American machines, the Heidbrink, Foregger, and McKesson are well known in Britain. Of these, the Heidbrink is the most commonly used machine in the States. They are all excellent and are equipped with circle absorption units, but can be adapted to to-and-fro absorption. However, there is no carbon-dioxide two-phase circle absorber, similar to the Coxeter-Mushin unit, American circle-absorbers acting only on one phase of respiration. Machines in the States have no provision for non-interchangeable couplings, but plans have

now been elaborated for a system by which cylinders can no longer be attached to the wrong yoke.

Gas-cylinders come in several sizes, varying from size A (20 gals. oxygen or 50 gals. nitrous oxide) to size G (3,200 gals. nitrous oxide) and H (1,825 gals. oxygen). Cylinder-outlet valves are all of the "American" type, being connected to the machine by means of yokes. The outer appearance of these cylinders is very clean and the paint is always in excellent condition. The distinctive colours are quite different from those in Britain at present, but a system of international colours is being elaborated at the present time.

Laryngoscopes are of many types, the most popular ones probably being the Guedel, Flagg, and Wis-Foregger blades. The Mackintosh-laryngoscope is used by many, but is less commonly seen than in Britain.

As for intravenous therapy equipment, the striking feature in the States is the use of disposable administration-sets. They are made of plastic material and are discarded after use. Although wasteful, it is much superior to the rubber-tubing set used in Britain and has been universally adopted in the States. Pyrogen-reactions from unclean tubing therefore do not occur. The various solutions are commercially available and hardly ever are manufactured by hospital dispensaries. Blood is usually available in ample quantities. Syringes are of the all-glass type, and cold-sterilization is not favoured.

Oxygen-therapy is administered by tent, mask or catheter. Although preferences vary with the individual anæsthetist, one may say that by and large the naso-pharyngeal catheter occupies the place for the surgical patient which in Britain is taken by the B.L.B. mask and similar types.

TRAINING AND QUALIFICATIONS

Undergraduates. Problems of undergraduate-training in anæsthesia in the States are very similar to those in Britain. The time allotted for teaching is totally inadequate and the student leaves his Medical School with very little practical experience and with only a sketchy theoretical background. In our own Institution a course of twelve lectures is given to the " Junior-Class " (penultimate clinical year) after they had received very thorough instruction in the pharmacology of anæsthetic drugs in the course of their previous studies. " Seniors " (final year students) then attend for one week, or sometimes two, in the Operating-Rooms where an attempt is made to teach them practical anæsthesia provided cases suitable for instruction are available. Emphasis is laid on teaching " open-drop ether " and, circumstances permitting, " nitrous oxide-ether sequence " and " spinals ". They are warned from employing any other agent after qualification without further instruction. Although our scope for practical tuition of students is very small, yet our school is well above the average in the country as far as time allotted for instruction in anæsthesia is concerned.

Postgraduates. Postgraduate training and instruction, on the other hand, is excellent. A residency of at least two years in an approved institution is minimum requirement for Board-Certification. During this time much emphasis is laid on basic sciences, particularly physiology and pharmacology, and the student is impressed with the fact that technique occupies second place of importance. The postgraduate student receives a wide variety of cases which include thoracic surgery, neuro-surgery, eye, E.N.T.,

orthopædic, pediatric and geriatric cases. He receives instruction, both practical and theoretical, in the management of shock and resuscitation, in blood-transfusion and in the maintenance and restoration of water- and electrolyte-balance, in the management of respiratory emergencies other than those occurring during anæsthesia, and in the indications and performance of diagnostic and therapeutic nerve-blocks. In our own institution residents also attend a one-week course in bronchoscopy in co-operation with the Department of Broncho-œsophagology.

There exists in the States a vast opportunity for post-graduate instruction in the frequent meetings of scientific societies. Local Anæsthesia Societies exist in the larger towns, and they usually meet once a month. There are also Regional and State Anæsthesia Societies who hold scientific meetings from time to time, and the national societies with a yearly Congress. Other medical societies frequently have one or two anæsthetic topics on the agenda of their scientific meetings, and most teaching-institutions hold anæsthesia-seminars at least once a week and often more frequently. They also offer from time to time refresher-courses in anæsthesia or in special techniques, such as intubation, bronchoscopy, etc. Seminars apart, there hardly passes a month when some meeting of interest to the anæsthetist does not convene within reasonable reach of all except those who practise in the most remote parts of the country.

Qualifications. There are two main qualifications in Anæsthesia in the United States. The F.A.C.A. (Fellow of the American College of Anesthesiologists) is awarded upon examination to those who do not yet hold the licence of the American Board of Anesthesiology, but who have completed one year in an approved residency, or who have

practised anæsthesia for not less than five years. The examination consists of a written, an oral, and/or practical part, and the requirements are similar to the D.A.

The Diploma of the American Board of Anesthesiology is the ultimate goal of all anæsthetists. It requires graduation from an approved medical school and an approved interneship. A candidate must have limited his practice to anæsthesia as a specialty for five years of which at least two years must have been spent in formal approved training, and he must be a member in good standing of an approved national, state, or local society. The diploma is awarded after very thorough examination in three parts, namely written, oral, and practical, and the standard is very high indeed. Holders of the diploma must limit their practice exclusively to anæsthesia.

Apart from these, special qualifications are obtainable from some Universities, such as Master of Science (Anesthesia) and similar higher degrees. The International College of Anesthetists also awards a Fellowship, the F.I.C.A.

PERSONNEL, STATUS, AND SCOPE OF ANAESTHESIA

Nurse-technicians. One of the most striking features of American anæsthesia, and also one of the most controversial ones, is the existence of nurse-technicians in many States of the Union. These nurses receive a course of training up to twelve months, but often this is much less or only amounts to a short term of apprenticeship with a more senior nurse. In many of the smaller hospitals (and in some of the larger ones too) no physician-anæsthetist is even on the hospital staff. These nurses work under the direct supervision of the surgeon who also bears the medico-legal responsibility

for their work. In some places these nurse-technicians even carry out intubations, and in rare instances administer spinals. This situation has arisen because of the reluctance in years gone by for physicians to enter the field of anæsthesia; even today the demand for medically qualified anæsthetists much outstrips the supply. However, there is a gradual trend away from nurse-technicians ("Anesthetists") in favour of medical "Anesthesiologists", and more and more surgeons have come to recognise the value of having a colleague at the head of the table and of thus being relieved of a heavy burden of responsibility; not to mention the better service obtained. But still there are many who will not part with nurse-technicians. This is a tricky problem, as yet only partially solved, and certainly the economic implications of medical anæsthesia play a very important role. However much one may deplore the intrusion of nurse-technicians into a field which should be the sole domain of medical practice, one cannot forget that the nurse with her empirical knowledge and with her practical experience in anæsthesia is probably the lesser of two evils when compared with the newly-qualified house-surgeon whose lowliest duty commonly in British hospitals is to administer anæsthetics.

It is probably the existence of nurse-anæsthesia in the States which has delayed for so much longer than in Britain the recognition of anæsthesia as a fully-fledged specialty. To-day anæsthesia has achieved recognition in the larger sense of the word, although individual surgeons and some hospital-administrators continue in their refusal to accept this as a fact.

Anæsthetic-orderlies. Except for some few places, the anæsthetic-orderly is non-existent in America. The anæs-

thetist services his own machines, changes cylinders, prepares his own trays, and "cleans up the mess" at the conclusion of his labours. Any help he may require, he must ask from the "circulating nurse" and gets "when she has time". Occasionally, he may get assistance from a nurse-anæsthetist. This certainly is somewhat hard on the newcomer from Britain who has come to expect his machine ready for use, his syringe laid out, spinal trays set, tubes lubricated, and adhesive tape cut.

The *field of anæsthesia* in the United States includes what is implied in the training of residents, namely fluid-therapy, transfusions, oxygen-therapy, diagnosis and relief of pain-problems of all sorts, and bronchoscopy when related to the anæsthetic procedure. The anæsthetist is frequently called in for consultation on cardio-respiratory problems and on problems of resuscitation, and he should be the expert consulted in the care of the patient unconscious from any cause. Most anæsthesia-departments control the oxygen-therapy equipment and its maintenance for the whole hospital.

RESEARCH AND RECENT DEVELOPMENTS

Research in anæsthesia and related fields is very active indeed in the States. Much work is being done in pharmacological investigations and in the physiology of respiration and circulation. Co-operation is very intimate in most centres between the departments of Anæsthesia, Physiology, and Pharmacology, and anæsthetists are often regarded as "Applied Physiologists and Pharmacologists". Indeed, many an anæsthetist has joined the specialty from the ranks of one of the basic sciences.

There is a constant flow of new pharmaceutical prepara-

tions which require attention, and although many of them are ultimately discarded, some very useful drugs have emerged and are constantly emerging from these studies. As examples of those which have probably come to stay one may cite new vasopressors (Methoxamine, Cyclopentamine, and a number of arterenol-like drugs), muscle-relaxants (dimethyl d-tubocurarine) and anti-curare drugs (Tensilon), ultra-shortacting barbiturates (sodium thioseconal or Surital) procaine amide, various blood-substitutes, and a host of new local analgesic agents. Other drugs, imported from abroad, have to be re-investigated and re-evalued for their place in anæsthesia in the States. Foremost of these are Syncurine, Myanesin, and Kemithal from Britain, Xylocaine and Dextran from Scandinavia, Flaxedil from France, and polyvinylpyrrolidone, a blood-substitute, from Germany. Furthermore research is continuing in new preparations of older drugs, such as injectable quinidine, rapidly-acting digitalis-fractions, and benzocaine in solution. A very thorough study of re-evaluation of chloroform has been carried out at the University of Wisconsin some time ago. Research also continues in an attempt to improve existing anæsthetic machines and appliances, and in the development of new scientific instruments, such as gas analyzers, various electrical and electronic recording devices, and others employing radio-active isotopes. The use of music in the sedation of patients undergoing operation under regional or spinal analgesia continues to be explored at some institutions.

Postoperative recovery rooms are becoming very popular, and many of the better hospitals now have added these highly specialized units to their services. These units must not be confused with mere "wake-up rooms" present in

most institutions. The recovery-rooms are usually under the combined jurisdiction of the surgical and anæsthetic staffs, and are supplied with wall-oxygen and wall-suction; they are equipped to deal with all emergencies likely to arise in the immediate post-operative period.

The *prevention of explosions* is a subject under constant investigation. American anæsthetists are much more explosion-conscious than their British colleagues, probably because of the apparent greater frequency of such mishaps in the States. Conductive floors and conductive rubber, spark-proofing of equipment, air-conditioning and humidity-control in the operating-room are among the measures adopted to prevent such calamitous accidents. A " Staticator " has been devised which indicates the presence of static electric charges in the vicinity of the antenna of the instrument.

CONCLUSION

This survey must of necessity be rather sketchy, but we believe that it presents a fair survey of the situation as a whole. We hope it may acquaint our colleagues in Britain with the problems of anæsthesia in the United States and with the viewpoints of anæsthetists there, so that we may learn from one another and may go forward together with greater understanding of each other to the ultimate benefit of our patients.

A METHOD OF PASSING RYLE'S TUBES IN ANÆSTHETIZED PATIENTS

By T. R. STEEN

THE indications for gastric aspiration before and after operation are well-established, and for some operations it is usual to bring the patient to the theatre with a Ryle's tube in position. However, it is not rare for the anæsthetist to be requested to pass a Ryle's tube during the course of an operation, either because the need for it has only been made evident by operative findings, or because the tube passed beforehand has become displaced or blocked.

The common method of attempting to insert a Ryle's tube in an unconscious subject is to pass a laryngoscope and then, with a Magill's forceps, to coax the tube, an inch or two at a time, down the œsophagus. Even if all goes well this is an awkward procedure, especially if one has to burrow under the sterile towels; and quite often, even with normal dexterity, the tube being slippery with lubricant and softened by repeated boiling, there is nothing to show, at the end of all, but an abraded pharynx with a tube curled up in it.

There is, however, a quick, easy, certain, and atraumatic method of performing the requisite manœuvre, which, although very simple, does not appear to be well known. This is to insert, either "blind" or with the aid of a laryngoscope, a Magill's endotracheal tube (about No. 8 is most convenient) through the mouth into the œsophagus. The Ryle's tube is then passed well into the stomach down

through the Magill's tube; if the inside of the latter be freely lubricated this can always be done very easily.

To remove the Magill's tube, one withdraws it until its tip is in the pharynx, and grasps the Ryle's tube just above the œsophageal opening, either digitally or, under laryngoscopic vision, with Magill's forceps; this enabies the Ryle's tube to be held steady while the Magill's tube is slid back over it and removed.

If, as is usual, one desires to have the tube passing through the nose rather than the mouth, a nasal Magill's tube (about No. 5 for choice) is later inserted through the nose into the pharynx and its tip drawn out through the mouth. Into the lumen of its distal end is pressed the proximal end of the Ryle's tube, bent double for two inches or so, and withdrawal of the Magill's tube from the nose then brings the Ryle's tube to lie in the required position.

These manipulations sound complicated, but each step can be performed rapidly, simply, and without trauma. It is better to perform the manœuvre by stages than to start by passing the first Magill's tube through the nose into the œsophagus. The latter procedure is by no means so simple as to pass it through the mouth, and has the added disadvantage that a Magill's tube wide enough to take the Ryle's tube easily may cause trauma in the nose.

The presence or absence of an endotracheal tube for the anæsthetic does not appreciably affect the ease of the manœuvre, which might also be found useful in the management of patients unconscious from causes other than anæsthesia.

In describing his "new gastro-duodenal catheter" (which is manufactured in about the same range of diameters, 4–5.5 mm., as the Ryle's tube more commonly used

in this country) Levin (1921) claimed that "it can easily be introduced through the nose even when the patient is under anæsthesia". However, the general opinion has persisted that "in the absence of the swallowing reflex this may be difficult" (Conroy, 1943). Lundy (1942) and Conroy (1943) reported successful insertion of Levin-type tubes in unconscious patients both by means of laryngoscope and Magill's forceps, and by preliminary introduction of a naso-œsophageal Magill's tube; Conroy also recommended passing the Levin tube blind through the nose, imparting rigidity to it in its pharyngeal course and directing it into the œsophagus with a finger inserted into the pharynx. Some disadvantages of the first two of these methods have been indicated above, and the writer has not found any of them so reliable, for Ryle's tubes, as the method here advocated, which most surely overcomes the tendency of the tube to coil in the pharynx. Lundy (1942) "found it necessary" to use the method, which he described clearly, "in one instance" when his other, usually successful, methods had failed.

No consideration here put forward affects the universally agreed necessity of emptying the stomach with a full-sized stomach-tube before anæsthesia in cases of acute intestinal obstruction. Of course the full-sized tube can always be passed fairly easily whether the patient be anæsthetised or not, and should always be preferred if the gastric contents are too copious or too thick to be aspirated easily through a Ryle's tube. The advantage of the latter in the circumstances outlined are that it is better tolerated during recovery of consciousness and afterwards; and ward-sisters are pleased, when a Ryle's tube is needed after operation, if the patient returns from the theatre with one already in place.

I am indebted to Dr. Ernest Landau and Dr. R. F. Woolmer for helpful criticisms.

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ENDOTRACHEAL AND OTHER MODERN METHODS IN THE EIGHTEENTH CENTURY

By M. H. ARMSTRONG DAVISON

THE endotracheal technique was illustrated and described by Vesalius (1555), but his method entailed preliminary tracheotomy, as did the endotracheal technique of Trendelenburg (1871). The first accepted account of intubation through the glottis is by Macewen in 1880.

It is interesting, therefore, that endotracheal intubation, by the *oral and nasal* routes, was described by Kite in 1788, a hundred years before Macewen; and Kite himself does not claim to be the originator of the technique, which he used in resuscitation of the apparently dead.

In the year 1787, the Humane Society (now the Royal Humane Society) decided to offer prizes for the best essays on the Recovery of the Apparently Dead. The essay submitted by a surgeon practising at Gravesend, Charles Kite, Member of the Corporation of Surgeons in London, was awarded the silver medal, and this essay was published in 1788 in book form. As an appendix, there is a description of a pocket case of instruments to be used in the resuscitation of the drowned, of whom Kite apparently saw a great many in his work by the Thames Estuary.

A folding plate illustrates the contents of this case. One of the items, " shaped like a male catheter ", is labelled, " An

instrument to pass beyond the glottis" (Fig. 1). In a second plate, this instrument is shown attached to the "elastic

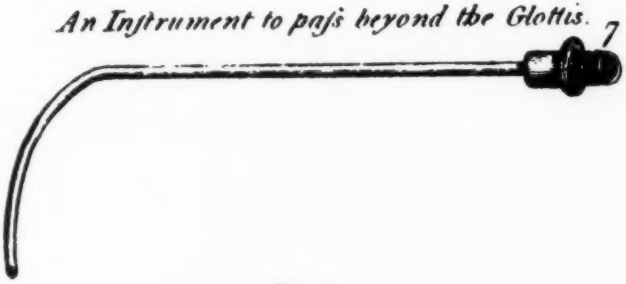

FIG. 1

tube", which could be used, either with this catheter, or with an ivory nozzle to fit the nostril (Fig. 2), for the inflation of the lungs.

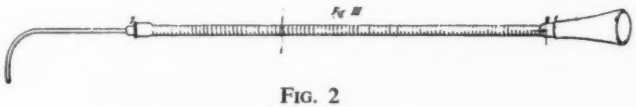

FIG. 2

In the text, the use of the catheter is mentioned thus:

"If any difficulty should arise in distending the lungs, it must proceed either from water in the windpipe or a contraction or adhesion of the epiglottis. We have already pointed out the method of discovering when the first circumstance occurs; and when the latter is the case, we shall generally remedy the inconvenience by bringing the tongue forwards, which, being connected to the epiglottis by inelastic ligaments, must of course be elevated. Should any further impediment however occur, the crooked tube, bent like a male catheter, recommended by Dr. Monro, and mentioned by Mr. Portal, Mr. le Cat, and others, should be introduced into the glottis, through the mouth or one nostril; the end should be connected to a blow-pipe, or, what will be more convenient, the pipe for the nose belonging to the elastic

> tube may be removed, and this instrument screwed in its place, according to the plan mentioned in the description of a pocket case of instruments for the recovery of the apparently dead, by Mr. Savigny " (the instrument maker).

The following description occurs in the Appendix:

> " Should further impediments however occur, the pipe for the nose is to be removed, and the crooked tube bent like a male catheter, recommended by Dr. Monro, and mentioned by Mr. Portal, Mr. le Cat, and others, is to be screwed on the tube in its place: this is to be introduced through the mouth, or one nostril, into the glottis, when, on blowing through the mouth-piece, or applying the bellows, the lungs will be dilated."

The reference to " Dr. Monro " cannot be identified, but it may be to Alexander Munro, primus, of Edinburgh, who apparently advocated the inflation of the lungs by artificial means as a method of resuscitation (Home, 1951). Antoine Portal (1742–1832) apparently advocated intubation by tracheotomy, but only as a last, desperate resource (Home, 1951). It appears that Claude-Nicolas le Cat (1700–1768) expressed a desire to see a tube designed which could be passed through the glottis to assist in artificial respiration (Fodéré, 1819).

From what has been written, it is obvious that Kite was a man of considerable ability, and a perusal of his book shows that he had a remarkable grasp on the subject of resuscitation. He recognised that laryngeal spasm, as distinct from closure of the glottis by the lowering of the epiglottis, could occur. After stressing that water is not generally found in the lungs of animals recently drowned, he writes, " Allowing then, what is, I think, clearly proved, that death is caused by contraction of the parts about the larynx stopping respiration—it still remains to enquire, concerning the manner in which this stoppage of respiration

acts, so as to occasion that effect". Earlier, he shows that he was aware that pulmonary œdema could occur in these circumstances, and that this might mislead investigators into thinking that water had been aspirated into the lungs:

> " In answer to those who maintain the third opinion, it will be proper to observe, that although water has, beyond doubt, often been found in the lungs of drowned animals; yet that it is frequently absent, is evident from the experiments of men of undoubted authority. Frothy mucus, now and then mixed with blood, is very generally to be met with in the lungs, and sometimes in considerable quantity, owing to the blood and mucus being forced through the vessels by the great distension of the pulmonary artery; and this, I have no doubt, has frequently been taken for water: but if the animals are drowned in water tinged with a colouring substance, the fact will then be readily ascertained. Of ten kittens drowned in this manner, not one drop of the liquor was found in, or to be pressed out of the lungs."

As a further extension of this belief, he describes similar experiments to show that water never enters the lungs until death has occurred, and he points out that the spasm will relax at that moment, allowing water to " fall in ". This may not be entirely in line with modern belief, but it is not far removed from it.

It is not surprising to find that Kite had some, to us, curious notions concerning respiration. The following passage at least shows that Kite used the lancet less than his colleagues, and that he attempted to give reasons for his actions:

> " It is, however, to be observed, that large and repeated bleedings do not seem so indispensably necessary in the present instance, as in apoplexies arising from some other causes, as artificial respiration will in general answer the purpose of removing the over-distention of the venal system, consequently the compression of the brain, nearly as effectually and expeditiously; and is not liable to be attended with any disadvantages. In a full inspiration, the vesicles of the lungs are expanded, and at the same time

the capacity of the pulmonary blood-vessels is considerably increased, so as to receive a larger quantity of blood from the right ventricle. In expiration, the vesicles are collapsed, and the contents of the blood-vessels are, in consequence, driven into the left auricle and ventricle. This process, frequently repeated, will in a short time remove the congestion in the great vessels; and the compression of the brain, which depended upon that congestion, will, I conceive, be as readily overcome as by opening a vein. On this account, and particularly as it is removing the cause of death, we cannot hesitate one moment in pronouncing, the restoring of the action of the lungs to be of the very first importance in all our attempts to recover the apparently dead. Dr. Fothergill, with great propriety, compares the lungs of drowned people to a clock whose pendulum has stopped; yet, says he, renew but the action of the lungs in the one, and touch but the pendulum in the other, and all again is life and motion. The same gentleman observes, in another place, that to inflate the lungs, especially of drowned persons, completely, requires no inconsiderable share of skill and dexterity."

Yet none can deny the wisdom and truth of the principles which he laid down. Although he described various methods of "removing the compression of the brain, and the congestion about the heart and lungs", and of "exciting the irritability of the muscular fibres", yet he states categorically:

"Let it be observed, as an invariable rule, that in all attempts to recover the drowned, our attention should be principally and primarily directed to—the administration and proper regulation of the inflation of the lungs—and the application of heat."

Concerning the inflation of the lungs by the insertion of a tube into the nostril or by mouth-to-mouth breathing, he suggests a manœuvre which might well be adopted by modern anæsthetists who wish to perform so-called "controlled" respiration in the absence of an endotracheal tube; namely, "by making a suitable pressure on the prominent part of the wind-pipe, he prevents the air passing into the stomach".

Should all other methods of inflation fail, tracheotomy is advocated as a last resort, a tube to be inserted and the lungs inflated by a bellows; " I acknowledge, however, I should not expect it would succeed when the other means have failed ".

There are other points on which Kite held extraordinarily advanced views. For instance, he foreshadows the more recent knowledge of the stimulation of respiration by exciting reflexes from the tracheo-bronchial tree: " Air loaded with the vapour of tobacco—of the volatile alkali—of the spirit of sea salt—and spirit of sulphur, have been recommended with the view of exciting the action of the lungs with greater expedition ". However, he casts doubts on the advisability of using these stimulants, and continues:

> " With fairer prospect of success, is the dephlogisticated air of Dr. Priestley recommended for the same purpose. Dr. Fothergill, in particular, has distinguished himself by his truly ingenious remarks on its application to the subject now under our consideration. It must be observed, however, that in this instance the Doctor's practice seems entirely influenced by a theory, which supposes the cause of death, in drowned people, to be noxious air stagnant in the cells of the windpipe; and as this species of air neutralises mephitic air, and renders it respirable, ' it seems,' says the Doctor, 'to be the direct antidote supplied by nature for correcting the contaminated air stagnant in the bronchial cells, and also for inflating the lungs, in preference to common air '."

He is not convinced of the efficacy of dephlogisticated air, but is willing to give it a trial. He points out the difficulties, however, because, for only 10 minutes of artificial respiration at 10 inflations per minute, no less than 30,000 cu. inches of gas (two hogsheads) would be required. This would be very expensive, but, he writes, and those in charge of health services might well consider, " The costliness of the article, however, is the most trifling objection

which can be brought against it, and could not require one moment's consideration, was it found to answer, and could it be readily procured and conveniently administered".

It should be remembered that, at the time Kite wrote, the discovery of oxygen (dephlogisticated air) had only been published 13 years before (Priestley, 1775), and its part in respiration was yet unknown; a somewhat conservative outlook was therefore natural.

Like those in our own day, Kite realised the difficulty of determining whether death had or had not occurred. He relied upon no one sign, but thought that lack of response of muscles to electrical stimulation was proof that the state of death was irreversible. He also used the electric current to hasten recovery, and noticed that the diaphragm could be brought into action by it. He writes:

> "The part which, in my experiments on drowned animals, I found to be the most readily excited to action, was the diaphragm; and although the shocks were directed so as to pass through the auricles of the heart, consequently much above that muscle, yet it was always brought into great contractions."

He could hardly be aware that the shocks he was administering were probably exciting diaphragmatic action by stimulating the phrenic nerves in their course past the heart. It was not until 1863 that Kidd and Lobb (Sansom, 1865) showed that electrical stimulation of the phrenic nerves was a practical method of performing artificial respiration.

Kite, in his book, deals mainly with the recovery of the apparently dead from drowning, but he also discusses the similar state of those who have been hanged, struck by lightning, or are suffering from syncope. In each case, he stresses the importance of artificial respiration by inflation.

There is no doubt that he was a great practitioner of medicine, and his greatness is enhanced by his modesty. Every theory and every method are weighed in the balance. The extracts given above show that, although his references are unfortunately incomplete, he never fails to acknowledge the source of all his ideas.

Kite's book was published 163 years ago; medical science has risen to great heights since then, but there can be little doubt that an intelligent person, who has read no other work on the subject save Kite's, would be able to render better aid to a drowned man than most medical practitioners of to-day.

I wish to acknowledge my great indebtedness to Mr. G. F. Home, Librarian of the Royal Society of Medicine, who has given me most valuable assistance and information concerning Kite, Portal and le Cat.

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NOTES AND COMMENTS

A NEW LARYNGOSCOPE

A laryngoscope with detachable blades is illustrated in figures 1 and 2, the design of which, I believe, corrects the principal mechanical defects found in all other types I have yet encountered. The instrument is adaptable to the generally accepted and well-established types of blade. The drawbacks which I invariably encounter with most types of detachable-blade laryngoscopes are two-fold:

(1) The methods of attaching and detaching the blades are awkward and time-consuming.

(2) With even moderate use, the junctions, particularly of the articulated types, tend to become loose, resulting in defective electrical contacts.

The instrument consists essentially of a battery-containing handle of similar size and design to the existing Magill and Macintosh types. At one end of the handle there is a threaded socket, and at the other end a simple press-switch operable by the thumb of the hand holding the instrument. The blades, which may be of any design, are fitted with a lug which carries a short helical thread and a central electrical contact. It is only necessary to insert the threaded portion of the lug into the socket of the handle and by merely rotating the blade through ninety degrees, a rigid and secure junction is made.

The central electrical contact bears directly on the battery terminal and depresses the battery against the tension of a

FIG. 1

FIG. 2

coil spring in the base of the handle. This coiled spring permits sufficient excursion of the battery to compensate for any wear in the helical thread that is likely to take place, and, therefore, an effective electrical contact is always ensured.

The Magill-type blades supplied with the instrument have been modified in two respects:

(1) The ends of the blades have been made more spatulate.

(2) The tips have been rolled to minimise the chance of trauma during use, a feature in laryngoscope design which I believe Dr. Magill originated, but which has, unfortunately, tended to disappear over the passage of years, during which Dr. Magill's blades have been in widespread use.

The laryngoscope at present is supplied with a full range of Magill- and Macintosh-type blades, and, for those who prefer a lightweight handle for use with the infant-size blade, an alternative is provided utilising a pencil-size battery.

The helical thread on all blades and both handles is standard, thus providing complete inter-changeability, and the instrument is obtainable from Messrs. A. Charles King Ltd.

I am indebted to Mr. L. Gibbons for his kind and able assistance in evolving this instrument.

W. KIRK RAE,
London

The following films of interest to those teaching anæsthesia have been added to the Imperial Chemical Industry Film Library:

The Lymphatic System.

Functions of Carotid Sinus and Aortic Nerve.

These can be obtained from the following address:

Film Library, I.C.I. Ltd., Bolton House, 61 Curzon Street, London, W. 1.

From 25th November to 1st December, 1951, there will be held in Paris the XXIVth " Congrés Internationaux de Chimie Industrielle ". The organisers of this Congress consider that there may be anæsthetists who will be interested and have sent to the Editors documents giving a great deal of information about the programme and arrangements. A feature of some interest in this Congress will be the exhibition of laboratory and industrial equipment which will be held in the Salon de la Chimie, and there will be a room specially devoted to the exhibition of new apparatus which has not yet been put into commercial production. If anybody is interested or requires information the Editors would be very glad to be of assistance.

We have been asked to draw the attention of our readers to the fact that the firm of J. F. Macfarlan & Co., the long established manufacturers of anæsthetic drugs, has been converted into a private limited company and will be known as J. F. Macfarlan & Co. Ltd. as from 1st June, 1951. The Directors will be known as follows:

D. Rainy Brown, B.A., Chairman and Joint Managing; N. Rainy Brown, Deputy and Joint Managing; R. H. Mathew; S. J. Bolton, B.Sc., F.R.I.C.

CORRESPONDENCE

REBREATHING IN A SEMI-CLOSED SYSTEM

Sir,

I have read with great interest the article by Molyneux and Pask entitled " The Flow of Gases in a Semi-Closed Anæsthetic System " (*Brit. J. Anæsth.*, **23**, 81).

I feel that the fourth assumption stated in the Appendix (*i.e.* that the quantity of gas supplied by each source will be proportional to its rate of flow) needs qualification. It holds true at the beginning of expiration, until such time as the pressure within the system has distended the bag and opened the expiratory valve. Thereafter, the valve being open, the expired gases flow out, while the flow from the machine drives along the tube and out through the valve an equivalent volume of the contents of the tube.

The assumption quoted above applies then to the gases filling the bag, but with this further qualification, that the two sources are on the one hand the anæsthetic machine, and on the other hand the *tube* (not the *lungs*).

The volume of gases in the tubing between the bag and the expiratory valve is, in the standard equipment, above 800 ml., which is well over the tidal volume. Thus no gases from the lungs can reach the bag. Expired gases can only fill the distal part of the tube, and will be driven out by the gas flow from the machine. So long as the volume of gases supplied equals the minute volume of respiration, there will be no rebreathing.

If the above viewpoint is correct it can be seen that the backflow measured by the authors of the article may amount to well over 150 ml. without there being any rebreathing.

F. G. DOMAINGUE
Mauritius

ROTAMETERS IN ANAESTHESIA

Sir,

So the Rotameter controversy is on us again. I can find no confirmation that the correspondence on this subject was closed by the Editor of the *Lancet* some ten years ago, and I naturally believed at the time that the exchange of opinions was stopped abruptly by the intervention of Mr. Trost of the Rotameter Company, who declared (*Lancet*, 1942, **1**, 92) that the adaptation of rotameters in a form suitable for anæsthetic apparatus was suggested by Mr. Richard Salt of this department.

Previously it had been suggested that the credit might belong to Mr. Charles King, but Mr. King did not share this view (*Lancet*, 1942, **1**, 27). In your last issue (1951, **23**, 3, 196), it was hinted that Mr. Talley might be able to throw some light on the subject under discussion. What Mr. Talley now thinks I do not know, but in a letter to me dated 23rd June, 1939, he clearly believed that the credit belonged to Mr. Salt.

I agreed wholeheartedly with the annotation on the rotameter (*Lancet*, 1941, **2**, 718); if anyone now thinks it inaccurate I would be more than pleased for the evidence to be considered by three referees appointed by yourself and the decision announced at a dinner for five at the loser's expense.

R. R. MACINTOSH
Oxford

REVIEWS

The Medical Annual 1951. Edited by Sir HENRY TIDY and A. RENDLE SHORT. 420 pp., 57 plates, 38 text illustrations. Published by John Wright & Sons Ltd., Bristol. Price 27*s.* 6*d.*

The publishers draw attention to the new price, 27*s.* 6*d.*, as against 25*s.* A very moderate increase when we remember that the price of paper today is between six and seven times the pre-war figure. No-one will grudge the extra 2*s.* 6*d.* for this invaluable mine of information, however much they may regret the conditions that have brought it about.

The Editors, in their introduction, indicate what is new in this volume. The paragraphs on " Legal Decisions " and " Legislation " call for special attention on the part of all doctors and would-be benefactors of hospitals. As the Editors point out " Nationalisation " has a legal sense which differs from the ordinary meaning of that word.

Dr. Langton Hewer again writes the section on Anæsthetics and illustrates the excellent Trilene Inhaler of Macintosh and Epstein and refers to some dangers apt to be encountered when using curare.

Chloroform: A Study after 100 *years.* Edited by RALPH M. WATERS. 125 pp., 35 figures. Published by The University of Wisconsin Press. Price 24*s.* 6*d.*

A book by Dr. Waters, or one for which he is in any way responsible, is bound to be of great interest to all anæsthetists; that interest is much enhanced by the fact that the

present work is concerned with chloroform and goes a long way to show that its neglect as an anæsthetic is not justified by the facts. The "facts", as revealed by the work of Drs. Orth, Pohle, Leroy, Sims, and Cohen, are somewhat different to those to which we have been accustomed in the last quarter of a century. Thus "Hepatic dysfunction as evidenced by variations from normal in one or more of the tests, was noted in 52 per cent of the individuals anæsthetised with $CHCl_3$ and in 44 per cent of the control group". And again, "A comparison of 40 $CHCl_3$ and 40 control anæsthetic administrations failed to reveal significant differences in postoperative renal function." The effects of $CHCl_3$ on the cardio-vascular system may be divided into the immediate and the remote; dealing with the latter first, the authors of this particular chapter say, "The results do not substantiate the statements in textbooks that $CHCl_3$ causes a gradual and continuous fall in blood pressure or that it cannot be used for much longer than one hour." As regards the immediate results, they say, "No evidence of any marked tendency to ventricular fibrillation was obtained." Where severe cardiac depression took place, and in one instance the heart stopped beating, "Prompt inflation of the lungs with oxygen almost instantly restored what appeared to be normal conditions in every instance." One would like to emphasise that statement, many years experience with $CHCl_3$ shows that the prompt exhibition of oxygen is of paramount importance in restoring to normal a patient suffering from cardio-vascular depression due to $CHCl_3$. To emphasise this matter still further, "exhibition" is the wrong word, for merely to show oxygen to the patient is useless, "inbibition" is the right word, for that means, to absorb, "to drink in". Dr.

Gillespie's statistics show that in the series given, namely, 1,111 cases, " It cannot be mathematically demonstrated that the probability of death or serious postoperative complications is higher with $CHCl_3$ than with any other agent ". Dr. Water's final conclusion from these researches is that $CHCl_3$ does not deserve to be abandoned as a surgical anæsthetic. But it should be in the hands of an expert willing to give concentrated attention to his job, furnished with a suitable instrument, and oxygen immediately available. He points out that $CHCl_3$ is the most potent anæsthetic we have. It naturally has the defects inherent in its qualities. He does not mention its use as a valuable aid to supplement the deficiencies of its weaker brethren nor its unique value (though this is implied) in teaching concentration of the job in hand. Every teacher of anæsthetics would do well to give more attention to this aspect of the subject than is the custom nowadays.

Chemistry and Therapeutics of Synthetic Drugs. By J. W. KEYSER. 162 pp. Published by George Newnes Limited, London. Price 42*s*.

The author of this book has set himself a difficult task in attempting to discuss the chemistry of synthetic drugs in relation to their therapeutic uses. A more fruitful scheme would be to discuss the relation between their structure and pharmacological actions. Indeed, the author to some extent quotes the original work which has been published on this aspect of the subject, though he consistently seems to prefer to use the term physiological properties.

The therapeutic use of a drug depends not only on the dosage and route of administration but on its rate of

absorption, distribution and clearance from the body. For example in Chapter 2, it is stated of the drug Pentothal that " small doses are sedative, medium doses hypnotic and large doses anæsthetic ". Now this barbiturate is rapidly absorbed and rapidly cleared and is therefore fundamentally unsuitable for sedation. Furthermore, its action as a general anæsthetic depends on its rapid administration intravenously to produce a high concentration of the drug in the brain; the same dose given intramuscularly or by mouth would not produce general anæsthesia.

The contents of the book are arranged in a series of chapters which deal with sedatives, hypnotics and general and basal anæsthetics. For the student it would be more logical to learn of the relation between structure and activity of these central depressant drugs before reading about their therapeutical application. Some transposition of the useful information given in these chapters would enable the reader to appreciate the reasons for choosing a particular drug for a particular purpose.

There is a full discussion of the chemistry of local anæsthetics and of antipyretic and analgesic drugs. Under the title of " Anti-bacterials ", antiseptics and disinfectants are summarised and an account is given of the treatment of specific infections by sulphonamides. Trypanocidal and allied drugs, anti-malarial drugs and miscellaneous drugs form other chapters in which it is not easy to trace much connection between structure and therapeutic use. There are also two chapters on the synthetic hormones and vitamins and an appendix of trade-names of drugs.

From the point of view of the " medical man " and also of the medical student this book gives interesting facts about the chemical structure and properties of drugs but affords

only a meagre account of the therapeutic use of drugs. Many pharmacists and chemists, however, will agree with Professor Linnell who, in a foreword, warmly welcomes the production of the volume, and points out the value of a book which gives students of chemistry some references to the actions of the drugs they learn to synthesise.

Nitrous Oxide Anæsthesia. By F. W. Clements, M.D. 3rd edition. 369 pp., with 129 illustrations and 2 plates. Published by Henry Kimpton, London. Price 46*s*.

This book, which is a memorial tribute to two of the great pioneers of anæsthesia—Dr. E. I. McKesson and Dr. F. H. McMechan—fully justifies its dedication. Dr. Clements, who is a pupil of these two past masters in the art, has produced a treatise of which he may be justly proud. It has long been the opinion of the reviewer that nitrous oxide has never been appraised at its true worth, and what Dr. Clements has written will go a long way towards rectifying this deficiency, and will materially add to the knowledge of the subject.

The book is well illustrated, and the text divided into sections, which makes easy reading.

Chapter V lifts the administration of an anæsthetic out of a mere technician's achievement into the realm of a scientific art.

In Chapter IX, the time factor in the induction of anæsthesia is very well described. This is not appreciated as it should be by many surgeons and some anæsthetists.

The title of the book does not do justice to the scope of the work, as there is included so much detail about other agents in addition to nitrous oxide and oxygen.

Some minor criticisms, however, must reluctantly be made.

On page 131 the word " stages " is used in the wrong sense. " State " or " phase " would be a better description.

Although in Chapter XX, analgesia for labour is described with nitrous oxide-oxygen, nothing is said about gas and air analgesia. This is rather surprising, as it is mentioned in dentistry.

More care should have been taken to prevent words being split at the end of the line. Page after page shows this fault, which rather offends the eye.

There are also quite a number of misprints and spelling mistakes. One of the former on page 306 is the dose of elixir phenobarbital given for premedication. Three fluid ounces is too large an amount when it is considered that this preparation contains gr. $\frac{1}{4}$ of phenobarbitone to the drachm.

This excellent textbook is highly recommended, and should be of great value to all those studying for a diploma in anæsthesia.

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